LIA-20 Control System Project

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Introduction
Linear Induction Accelerator LIA-20 is designed to provide three consecutive electron beams with an energy up to 20 MeV, current up to 2 kA and the beam lateral size after focusing on the target less than 1 mm. It is planned to have one of the pulses divided into 9 angles. The accelerator will be used for the flash X-Ray radiography. Successfully commissioned LIA-20 accelerator (2 MeV, 2 kA) could be considered a prototype for the injector of the 20 MeV installation. The installation consists of a large number of complex electrophysical devices that require extensive control. First stage of commissioning will be a 5 MeV installation.

Structure of the Linear Accelerator Part

- Target
  - Long Accelerating Modules
  - Short Accelerating Modules
  - Injector
  - Pulsed Power Supply Racks

Problems of scale:
- 480 modulators
- Length ~ 120 m
- > 6000 control channels

Reliability requirements
- Components
  - Pulsed Power Supply Rack:
    - 8 modulators
    - Demagnetizing device
    - Charging devices
    - Beam position monitors
    - Lense power supplies
    - Cathode power supply
    - AM positioning system
    - Vacuum pumps

Control System Structure
- Control Rack 1
  - Control Rack 2
  - Control Rack 3

- Linear part
  - Slow controls subsystem
  - Geodetic measurements
  - Vacuum, power supplies, etc.
  - System infrastructure:
    - cranes
    - controllers
    - interfaces

- VME-BINP Crate
  - For more details visit THMLP10!

Slow Controls Subsystem
1. Beamline elements positioning:
   - Angle positioning (water)
   - X-Y positioning (wire)
2. Pulsed power control
   - Modulators
   - Degaussing
   - Lense power supplies
3. Cathode heater control
4. Vacuum control
5. Crate power control

Measurement Subsystem
- "Fast" signals
  - Duration ~10 us, 4 ns per point
    - 16 inductor voltages
    - 4 BPM signals
  - Kicker voltages 1 ns per point

- Total > 480 channels

Synchonization Subsystem
- 2000 Channels
- The synchronization subsystem provides all the controlled and controlling devices with the start pulses. The overall accuracy must be better than 4 ns across 70 m of length. This means that the propagation delays between the control units must be taken into consideration and negated.

Fast Interlock Subsystem
- For more details look up TUPHA103!
  - Inhibit the experiment at ~ 200 m, with reaction time < 20 us

System Infrastructure
- The system infrastructure is built upon COTS hardware: Intel x86-64 servers and multi-monitor x86-64 client machines.
  - Ubuntu LTS is used both on server and client machines.
  - Debian is used on controllers.
  - Software is TANGO-Based

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